"Compact Color Biofinder" for fast, non-contact detection of bio-markers, biomolecules and polyaromatic hydrocarbons in Ocean Worlds (CoCoBi)

Completed Technology Project (2017 - 2020)

Project Introduction

We have developed a prototype instrument called “Standoff Biofinder” which is able to detect biomolecules and bio-markers from a collection of rocks and minerals in a large area with detection time of 0.1 s. The Standoff Biofinder takes advantage of the short lifetime of bio-fluorescent materials to obtain real-time images showing the locations of biological materials among luminescent minerals in a geological context. The instrument works in daylight as well as nighttime conditions and bio-detection capability is not affected by the background light. The Standoff Biofinder instrument will be suitable for locating fluorescent polyaromatic hydrocarbons, amino acids, proteins, bacteria, biominerals, photosynthetic pigments, and diagenetic products of microbial life both on dry landscapes as well as on Ocean Worlds of the outer Solar System (e.g., Enceladus, Europa, and Titan). At present, the images provided by the prototype biofinder are black and white images displaying the morphology and concentrations of biological molecules. In this proposal, we propose to develop the next generation of the instrument, “Compact Color Biofinder” (CoCoBi) which will provide color fluorescent images of biological species in a target area. One of the advantages of the color biofinder over the present biofinder system would be ability to differentiate multiple biological materials in a target area which may contain a mixture of biological species in various concentrations. CoCoBi will be helpful in identifying the biological materials based on their fluorophore colors, along with morphologies and concentrations. In addition, the color-biofinder will be significantly miniaturized in size and will be an ideal “search for life” future mission instrument. CoCoBi will be designed to look for ppm levels of biomaterial from a standoff distance of several centimeters in a geological setting, as well as in water and ice, with detection time less than 1 s. An important feature of the Standoff Biofinder instrument is its capability to detect biomolecules which are deeper in water and ice, without sample collection. The CoCoBi instrument will be useful for locating a biological material during future NASA rover, lander, and crewed missions to Moon, Mars, Jupiter, Venus, Enceladus, Europa, Titan, asteroids etc. Additionally, the instrument can be used for non-contact, non-destructive detection of biological materials in priceless samples obtained from sample return missions from other planets and asteroids. Under this project, the TRL of the proposed compact color biofinder instrument will advance from TRL 2 to TRL 4.

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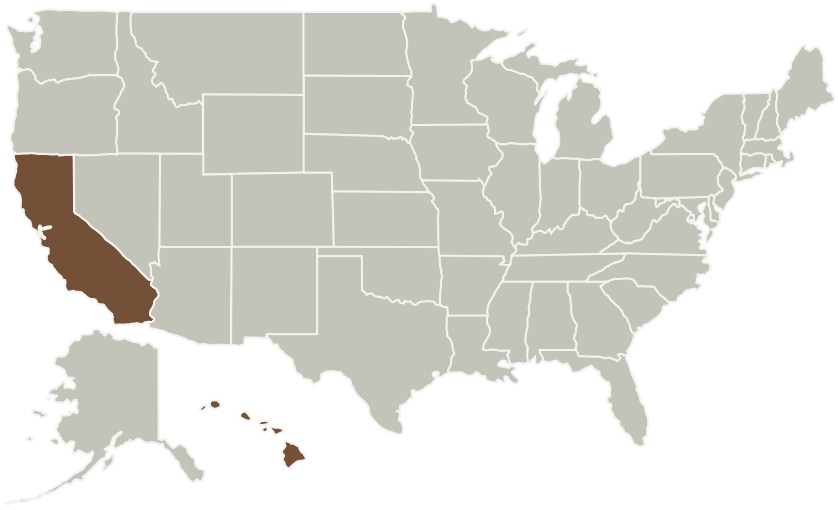
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Hawaii Maui College	Supporting Organization	Academia Alaska Native and Native Hawaiian Serving Institutions (ANNH), Asian American Native American Pacific Islander (AANAPISI)	Kahului, Hawaii

Primary U.S. Work Locations	
California	Hawaii

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Planetary Instrument Concepts for the Advancement of Solar System Observations

Project Management

Program Director:

Carolyn R Mercer

Program Manager:

Haris Riris

Principal Investigator:

Anupam K Misra

Co-Investigators:

David Garmire
Christopher P Mckay
John N Porter
Kyle Koza

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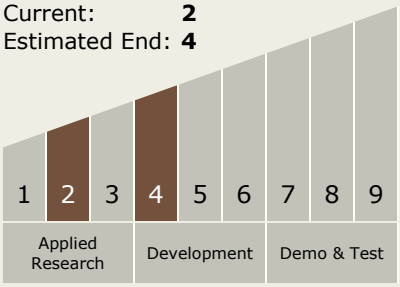
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

Target Destination

Others Inside the Solar System